DOCUMENT RESUME

ED 306 937 IR 013 679

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TITLE Sound Effects for Children's Comprehension of Variably-Paced Television Programs.
PUB DATE Aug 87
NOTE 23p.; Paper presented at the Annual Meeting of the American Psychological Association (New York, NY, August 28-September 1, 1987).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Comparative Analysis; *Comprehension; *Grade 4; Intermediate Grades; *Preschool Children; *Programing (Broadcast); Selection; *Sound Effects; Statistical Distributions; *Television Research
IDENTIFIERS Story Content; *Variable Pacing

ABSTRACT

In this study, children's selective attention to, and comprehension of, variably-paced television programs were examined as a function of sound effects. Sixty-four children, equally distributed by sex and by preschool and fourth grades, were randomly assigned to one of four treatment conditions which crossed two levels of sound effects (presence versus absence) with two levels of program pace (high versus low rate of scene change). It was found that sound effects increased children's selective attention to key program actions which, in turn, predicted children's comprehension of targeted story events. Effects were most pronounced in the rapidly-paced television program, particularly for the younger age group. The results suggest that young children's comprehension of rapidly-paced television programs can benefit if attention is guided selectively to significant story actions by sound effects. (18 references) (Author/CGD)

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Sound Effects for Children's Comprehension of Variably-Paced Television Programs

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Running Head: TELEVISION SOUND EFFECTS

This research was supported by a grant from the Home Economics Grant Foundation at the University of North Carolina Greensboro. We thank the staffs, parents, and children of the UNCG Child Care Education Program and of General Greene Elementary School in the Greensboro School System. We also thank the Center for Research on the Influences of Television on Children (CRITC), Paul Whitener, Katherine Clark, Rebecca Mahaley, Robert Nida, Tammy Wilkes Burchette, and Nancy Foltz for their assistance.

IR013679

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Abstract

Children's selective attention to, and comprehension of, variably-paced television programs were examined as a function of sound effects. Sixty-four children, equally distributed by sex and by preschool and fourth grades, were randomly assigned to one of four treatment conditions which crossed two levels of sound effects (presence vs. absence) with two levels of program pace (high vs. low rate of scene change). Sound effects increased children's selective attention to key program actions which, in turn, predicted children's comprehension of targeted story events. Effects were most pronounced in the rapidly-paced television program, particularly for the younger age group. The results suggest that young children's comprehension of rapidly-paced television programs can benefit if attention is guided selectively to significant story actions by sound effects.

Sound Effects for Children's Comprehension of Rapidly-Paced Television Programs

Rapidly-paced television programs, in which the scenes shift frequently from one setting to another, are typically designed for a young viewing audience (Huston, Wright, Wartella, Rice, Watkins, Campbell, & Potts, 1981), but such programs are not well understood by children (Wright, Huston, Ross, Calvert, Rollandelli, Weeks, Raessi, & Potts, 1984). Comprehension problems may partly reflect children's difficulty in selecting, linking, and integrating significant program information across many different scene changes (Collins, Wellman, Keniston, & Westby, 1978). In contrast to rapid pace, features like sound effects and character actions can facilitate children's comprehension of television content by marking certain content for further processing or by providing iconic modes which children can use to represent content (Calvert, Huston, Watkins, & Wright, 1982). The major thesis of this paper is that rapidly-paced television programs may become more comprehensible to young children if sound effects guide attention to actions that are central to the story theme.

Television content is presented through formal features, the audio-visual production techniques that structure, organize, and represent content (Huston & Wright, 1983).

Formal features vary in perceptual salience- that is, the degree to which features embody a high level of Berlyne's (1960) collative variables of novelty, surprise, incongruity, complexity and the like (Wright & Huston, 1983). Theoretically, perceptually salient formal features like rapid pace, high levels of action, and sound effects have been expected to enhance children's attention and interest in television content, particularly at young ages (Wright & Huston, 1983). Although sound effects and action have demonstrated attentional appeal to children (Alwitt, Anderson, Lorch, & Levin, 1980; Calvert et al., 1982), rapid pace has not, perhaps because rapidly-paced television programs are relatively incomprehensible to young viewers. More specifically, children attend to television programs that are comprehensible, and they fail to attend to programs that are incomprehensible (Anderson, Lorch, Field, & Sanders, 1981).

Rapid pace seems to require more mental effort for effective comprehension than does rapid action, perhaps because action visually links key events over time whereas rapid pace calls upon viewers to infer links between events over time (Wright, Calvert, Huston-Stein, & Watkins, 1980). Action, which has been linked to increases in children's comprehension of visually presented television content

(Beagles-Roos & Gatt, 1983; Calvert et al. 1982; Calvert, Huston, & Wright, 1987; Gibbons, Anderson, Smith, Field, & Fischer, 1986), provides an iconic mode to represent content which may be especially useful for young children. In contrast, rapid pace requires children to and infer and integrate story content across many different scene changes (Wright et al., 1984); such inferential skills are particularly difficult for young viewers (Collins, 1983).

Because young children have difficulty selecting important content during viewing (Collins, 1983), one strategy to improve comprehension has been to guide visual attention selectively to significant story events. In some instances, attention at key story points has enhanced comprehension as much as significant increases in overall levels of visual attention (Lorch, Anderson, & Levin, 1979).

Children may use auditory features like sound effects to guide their attention to television content that is useful to their current schema (Anderson & Lorch, 1983). Specifically, sound effects can signal children that something important is about to happen in the story. Sound effects have increased young children's selective attention to, and comprehension of, important televised content (Calvert & Gersh, in press). These findings suggest that sound effects might also enhance children's comprehension of

rapidly-paced television programs, particularly if salient character actions are marked for further processing.

The purpose of this study was to examine the usefulness of sound effects for children's attention to, and comprehension of, rapidly-paced television programs. Because children did not temporally integrate the rapidly-paced stories in the Wright et al. study (1984) well, we chose two programs, one high and one low in pace, for experimental manipulation. We expected sound effects to increase attention to targeted televised actions, particularly for the rapidly-paced program. Selective attention, in turn, was expected to increase children's comprehension of targeted program content. Developmental differences were assessed by comparing preschoolers to fourth graders.

Method

Subjects

Subjects were sixty-four children, equally distributed by sex and by grades preschool (M = 4 years, 11 months) and fourth (M = 10 years, 2 months), who attended one of two schools in a moderately-sized Southeastern city. Within grade and sex groups, children were randomly assigned to one of four treatment conditions.

Television Programs

Two, fifteen-minute, live, children's television

programs from the Wright et al. (1984) study were examined because children had more difficulty understanding the rapidly than the slowly-paced program, particularly at young ages. These two programs varied in the level of program pace, i.e., the rate of scene and character change. In "Thunder: The Adventures of a Super Horse", the low-paced program, a horse helps save a dog who has been poisened by drinking from a polluted stream. In "Search and Rescue," the high-paced program, a team of trained animals rescue a father and son who have been in a car accident. The low-paced program had 2.38 scene and character changes per minute whereas the high-paced program had 9.20 scene and character changes per minute. Both programs were stories.

Treatment Conditions

In all four treatment conditions, the program plot was retained. The treatment conditions crossed two levels of sound effects with the two levels of program pace. One-second sound effects of a slide whistle were used to mark significant story content. The marking procedure was implemented as follows. First, two sets of key visual program actions that were central to each program plot were selected and photographed. There were five events in each set. Then for each program, one set of story events was randomly chosen for marking. The two stimulus programs were

later edited so that sound effects preceded each of those five program actions in the marker conditions.

Procedure

Children participated individually in one thirty minute session in a vacant room in or near their school. Each child was seated at a table that had small toys and comic books on it. An experimenter told each child to read, play, and watch television just like at home and that some questions about the story would be asked after the program ended. She told the child that she had some work to do, but would stay in the room. With remote control buttons, the experimenter activated a hidden camera which videotaped the viewing session and a videotape recorder which played one of the four edited program versions. The experimenter then went to another area of the room and appeared to work on some papers.

Selective Attention Scores

Videotapes of children's visual attention to the television program were later scored to derive three microattention scores. Visual attention was scored "on" when children looked at the television screen and "off" when they looked away. Recruit attention scores measured the probability that children who were not looking at the television program immediately before the five targeted program points would look back at the program within 5

seconds after the onset of treatment. Maintain attention scores measured the probability that children who were already looking at the onset of each of the five program points would continue to look for at least 5 seconds after the onset of treatment. Recruit and maintain scores were summed to compute selective attention scores, the number of times that children looked at the five targeted program actions.

Interobserver reliability for recruit and maintain scores (i.e., the selective attention scores), based on eight randomly selected viewing sessions, was 93%, calculated as 2 x the number of agreements divided by the total number of scores for both observers. Agreement occurred when both observers scored an onset or offset of attention within 5 seconds after a sound effect occurred or during that same program time frame in no sound effect conditions.

Comprehension

After viewing, each child ordered the two sets of five events that had been photographed from the television program in order to assess temporal integration of the plot line. For each program, one set of events had been marked in the television program by sound effects while the other had not been marked.

For each seriation set, the experimenter randomly

arranged the photographs in two rows and gave the following instructions: "Here are some pictures of things that happened in the story. I'd like you to put these pictures in order from the first thing that happened to the last-- just like it happened in the story." After a child had sequenced each set, the experimenter recorded the child's response order from numbers on the backside of the photographs.

Following procedures developed by Wright et al. (1984), picture sequence scores were calculated for each child by comparing the child's picture order to its correct absolute position and to the number of correctly sequenced adjacent pairs of pictures. To calculate this score, the pictures were correctly ordered from the first to last event. For each picture, one point was awarded for every picture that that had been correctly placed to its left. In addition, one point was awarded for each correct adjacent pair of pictures. The total picture sequence scores were calculated by adding the two parts, resulting in a maximum score of 14 for both sets.

Results

Selective Attention to Targeted Program Points

Sound effects were expected to increase children's selective attention to key program actions, thereby enhancing story comprehension. Selective attention scores, ranging

from 0-5, indexed the number of times that children looked at the five targeted program actions. Selective attention scores were submitted to a 2 (sound effect) by 2 (pace level) by 2 (grade) by 2 (sex) between-subjects analysis of variance.

The four factor ANOVA on selective attention scores yielded a main effect of sound effect condition, $F(1,48) = 7.57$, $p < .01$; a main effect of grade, $F(1,48) = 12.94$, $p < .001$; and a sound effect by pace interaction, $F(1,48) = 8.78$, $p < .01$. As predicted, children who heard sound effects ($M = 3.66$) were more likely to see the five targeted program actions than were children who did not hear sound effects ($M = 2.48$). As seen in Table 1, children who viewed the

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Insert Table 1 about here

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high-paced program were more likely to see the marked program actions when sound effects were present rather than absent, but children who viewed the low-paced program did not benefit from sound effects. Within the sound effect treatment conditions, children were more likely to see the key program actions when sound effects marked the high- than the low-paced program. In contrast, children who viewed the no sound effect conditions were more likely to see the key program actions in the low than in the high-paced program. Older

children (M = 3.78) were more likely to see key program actions than were younger children (M = 2.72).

The Relation between Selective Attention and Comprehension

Picture sequence scores, ranging from 2-14, were computed for the marked and unmarked picture sequencing sets. Because attentional patterns were different for younger and older children, correlations between the selective attention and comprehension scores were calculated separately for each grade. Then selective attention scores were used to predict each of the two comprehension scores in multiple regression analyses. For each grade level, sex, sound effect treatment, and pace level were allowed to enter the equation before selective attention scores. The results of the correlation and regression analyses appear in Table 2.

Insert Table 2 about here

Marked Seriation Set. As seen in Table 2, older $F(1,30) = 7.47$, $p < .01$, and younger children $F(1,30) = 6.75$, $p < .01$, were more likely to order the marked set of program events correctly when they had attended selectively to those program events than when they had not. Because sound effects did not enter the regression equation, the benefits of sound for children's comprehension were mediated through visual

attention. Pace did not affect comprehension of the marked set of program actions.

Unmarked Seriation Set. As seen in Table 2, selective attention at the five key program actions was also the first predictor of younger children's ordering of the unmarked set of program events, $F(1,30) = 6.30$, $p < .05$. This finding suggests that treatment effects had general as well as specific benefits for preschool children's comprehension of television content. After selective attention was removed, pace entered the regression equation, $F(2,29) = 5.63$, $p < .01$. Younger children sequenced unmarked events from the rapidly-paced program better than the slowly-paced program.

For older children, the level of program pace entered the equation as the first predictor of comprehension for the unmarked picture sequencing set, $F(1,30) = 17.19$, $p < .001$. In contrast to the preschoolers, fourth graders sequenced unmarked events from the low-paced program better than from the high-paced program. Selective attention scores did not predict older children's comprehension of the unmarked set of program events.

Discussion

As predicted, children who heard sound effects were more likely to attend to marked program actions than were children who did not hear sound effects, particularly for the high-

paced television program. Events in high-paced programs occur so rapidly that children's attention to significant program events may require more guidance than is necessary in a low-paced program. The results suggest that children are better able to allocate attention to rapidly-paced programs when significant story actions are marked by sound effects. As suggested by others (Calvert & Gersh, in press; Lorch et al., 1979), markers of important content seem promising as a means to guide young children's strategic attention to televised material.

Children's selective attention benefited from sound effects only in the rapidly-paced television program. Because producers are likely to include electronic embellishments like sound effects in high-paced television programs (Huston et al., 1981), sound effects may be more ecologically valid when inserted in a high-, than in a low-paced, program. Therefore, beneficial effects of sound may be limited to television programs which typically contain such techniques. Future research should extend the research base about markers by examining additional television programs, particularly animated shows where sound effects are often used.

As expected, selective attention to marked program actions predicted children's comprehension, particularly for the youngest age group. Selective attention scores increased

both age groups' comprehension of the marked set of visual program events, and, more importantly, increased preschoolers' comprehension of the unmarked set of visual program events. This finding suggests that treatment effects had a general as well as a specific impact on comprehension. The attention and comprehension findings are consistent with other literature which links selective attention to sound effects with enhanced comprehension of television content (Calvert et al., 1982; Calvert & Gersh, in press). Sound effects increase selective attention to television content, which, in turn, mediate improvements in comprehension.

When functionally relevant actions were marked, effects of pace on comprehension were eliminated. Children sequenced the marked set of events equally well in the high- and low-paced program. In contrast, pace affected both age groups' comprehension of the unmarked set of program events, a finding also reported by Wright et al. (1984). The results suggest that marking key story actions can attenuate comprehension problems that children encounter when viewing rapidly-paced television programs.

For the unmarked set of program events, the effects of pace on the two age groups were reversed. As found by Wright et al. (1984), older children sequenced events from the low-paced television program better than events from the high-

paced program. Low-paced program are probably very comprehensible to older children while high-paced programs are still difficult to understand (e.g., Anderson et al., 1981), accounting for their superior ability to sequence events from the low- over the high-paced program.

In contrast to the findings of Wright et al. (1984), younger children sequenced events from the rapidly-paced television program better than events from the slowly-paced program. Because rapidly-paced programs are typically targeted for a young audience, young children may be more attracted to television programs which include clusters of perceptually salient production techniques than to programs which do not (Huston et al., 1981). This interpretation is supported by young children's viewing preferences for rapidly-paced Saturday morning cartoons (Huston, Wright, Kerkman, & St. Peters, 1986).

In conclusion, selective attention to sound effects increased children's temporal integration of significant visually presented television content. By marking significant story actions with production techniques like sound effects, the comprehensibility of rapidly-paced television programs can be increased for young viewers.

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Table 1.

Mean Selective Attention to Marked Story Events as a Function of Sound Effect Treatment and Program Pace

	Sound Effect Treatment			
	Off		On	
	M	SD	M	SD
Pace Level				
Slow	3.31[b] (n=16)	1.15	3.25[b] (n=16)	1.30
Rapid	2.38[c] (n=16)	1.50	4.08[a] (n=16)	1.55

Means with different letter superscripts are significantly different at $p < .05$.

Table 2.

Zero-Order Correlations of Selective Attention Scores and Comprehension Scores for Marked and Unmarked Seriation Sets by Grade

	Marked Seriation Set		Unmarked Seriation	
	Preschool	Fourth	Preschool	Fourth
Selective Attention Scores	.43 a**	.45 a**	.42 a*	.25
Sex	.03	.00	.05	.10
Pace Level	.06	-.20	.32 b*	-.60 a***
Sound Effect Treatment	.31	-.05	-.03	.01
Proportion of Variance	18%	20%	28%	36%

[a] Variables with this letter superscript entered the multiple-regression equation as the first predictor of comprehension at $p < .05$ or less.

[b] Variables with this letter superscript entered the multiple-regression equation as the second predictor of comprehension at $p < .05$ or less. Variables were coded as follows: Pace (Slow=1; Rapid=2); Sound effects (Absence=1; Presence=2); Sex (Male=1; Female=2).

Codes for significance are as follows: *$p < .05$; **$p < .01$; ***$p < .001$.